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AN AIRCRAFT INSECT-TRAP DISPENSER

Plant Pest Control Division
Methods Improvement Operations

Insect traps, including light traps and food or sex lure-baited types, are used extensively for pest detection and special surveys. In addition, investigations are being conducted with trapping devices to determine their utility for insect control. Where insect populations are at low levels or isolated infestations exist, placement of large numbers of traps is being tested as a method of population suppression. Studies have been undertaken for control of light populations of the gypsy moth in forested areas. To conduct the saturation trapping investigation, a cylindrical trap was developed and a dispensing machine was fabricated to uniformly drop such traps from an aircraft (fig. 1).

The trap dispenser is electrically operated and can be adjusted to uniformly drop traps at any desired interval along the flight line of the aircraft. It was used successfully to grid gypsy moth-infested woodland with sex lure-baited traps attractive to the male moth. The cylindrical trap has an entrance hole at each end. The inside is coated with a tacky substance to entrap the insect. A small cotton wad in the trap contains a few drops of sex lure.

DESCRIPTION

The dispenser is comprised of a hopper, conveyor, emission duct, electrical system, and controls (fig. 2). It was built as a compact self-contained unit for simple installation in a variety of aircraft. It was designed to handle a cylindrical trap, 2 inches in diameter and 3 inches long; however, it can be modified to handle cylindrical traps of other dimensions.

Hopper--The top of the hopper measures 20-1/2 by 3-1/2 inches and the sides are 16-1/2 inches high. Three sides are vertical, and the lower part of the fourth side slopes downward and inward 60° from vertical. This reduces the hopper outlet to an opening 7 by 3-1/2 inches. The forward side is plexiglass so that the operator can observe the functioning of the conveyor and the traps in the dispenser.

Figure 1. --Airplane cabin interior showing trap dispenser, trap supply, and dispenser operator.

Conveyor--The conveyor is an integral part of the dispenser and is attached to the bottom of the hopper. It is housed in a compartment that contains the drive and idler shafts, chain sprockets, and baffled chain belt. The drive and idler shafts are mounted in sealed ball bearings to reduce wear and assure smooth operation of the conveyor.

An externally mounted housing contains an electric motor and gears to drive the conveyor. Different gear combinations can be used to vary the speed of the conveyor.

Baffles attached to the chain belt move the traps individually to the emission duct for release. Set approximately 2-1/2 inches apart, the baffles are hinged so the chain remains flexible to rotate around the sprockets. Metal stops hold the baffles upright while moving traps to the emission duct.

A 12-volt d. c. two-speed electric motor is used to power the conveyor. It is an automobile heater motor and readily available if it needs to be replaced. A voltmeter, with scale reading of 0 to 15 volts, is used in combination with the rheostat to make fine adjustments of the motor speed. This procedure is followed after preliminary speed adjustment has been made with gears and high or low position of the motor speed switch.

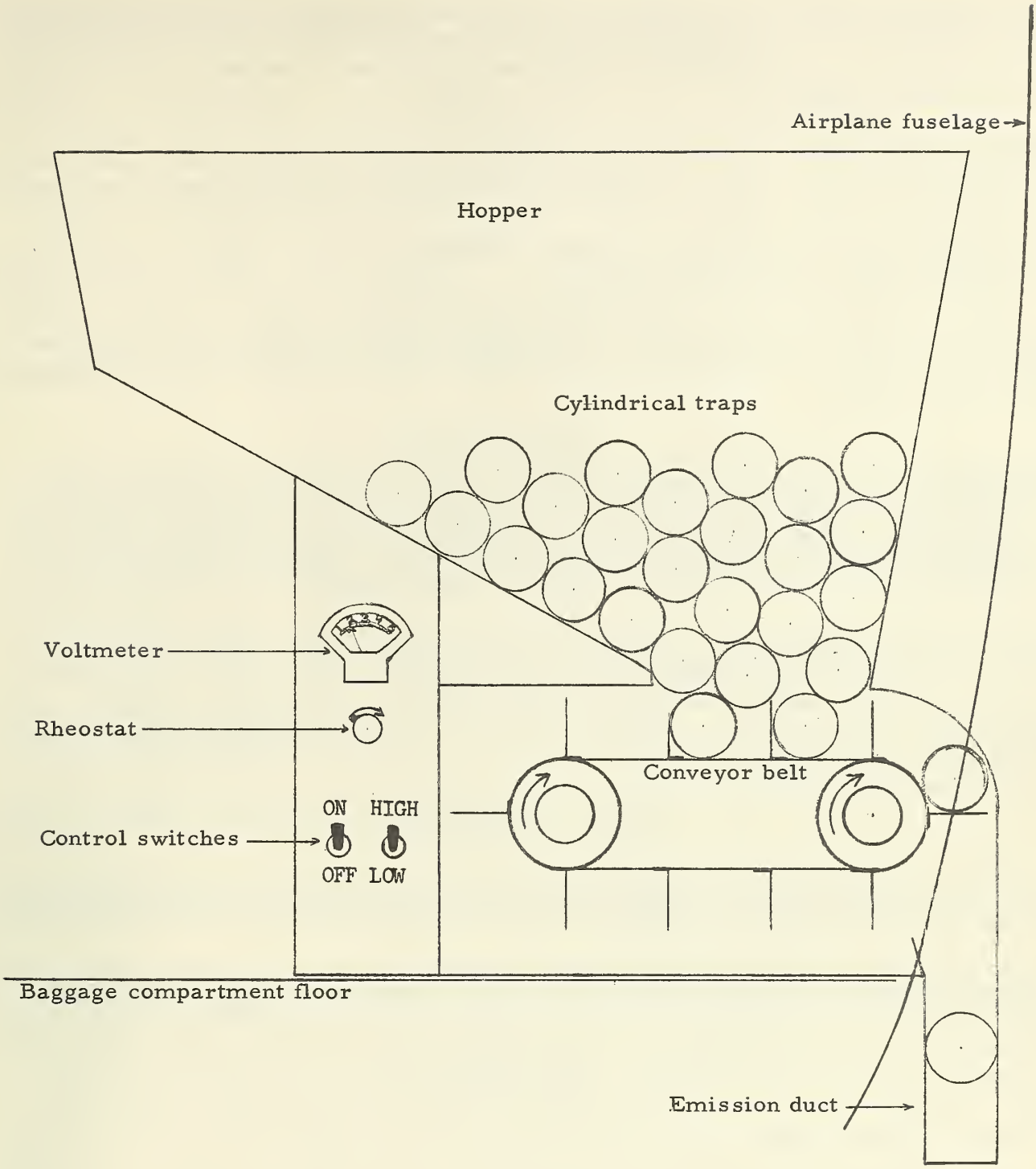

Figure 2. --Insect trap dispenser diagram showing forward side removed. Electric motor and conveyor drive gears are mounted on back side of dispenser.

Emission duct--The emission duct is attached to the end of the conveyor housing and extends downward, protruding outside the aircraft. The end of the duct is cut at a 15° angle to create negative pressure needed to accelerate traps into the slipstream.

Electrical system--The electrical system drives the conveyor. Several methods are used to control the speed of the conveyor and the number of traps dropped per mile. These controls consist of "on-off" switches, a speed-control switch, and a rheostat to control voltage to the motor. A 3-ampere fuse protects the electrical system.

Power to operate the dispenser is taken from the aircraft's electrical system. The power cord is plugged into the cigarette lighter socket on the aircraft's instrument panel.

Controls--To start and stop the conveyor, on-off switches are located on the dispenser and aircraft instrument panel. Trap release is generally controlled by the pilot. The pilot's switch is located so he can actuate it with his forefinger without removing his hand from the throttle. If the conveyor malfunctions, the switch on the dispenser can also be used to stop the motor.

The operating speed of the conveyor is determined by the number of traps to be dropped per mile. Speed of the conveyor is controlled by a "high-low" r.p.m. selector switch (for the two-speed electric motor) and a rheostat to adjust motor speed by increasing the voltage. Precise adjustment is normally made with the rheostat.

INSTALLATION

Only minor alterations are needed to facilitate installation of the dispenser in a Cessna 180 or similar aircraft. 1/

Seating changes--The rear passenger seat is removed to provide maximum cabin space for carrying traps. The copilot seat is installed facing rearward directly behind the pilot seat so that the dispenser operator is directly in front of the dispenser and its controls. From this position, he can easily reach all trap loading cartons that can be carried in the aircraft and also observe trap flow into the conveyor.

1/ Trade names are used in this report solely to provide specific information. Mention of a trade name does not constitute a guarantee or warranty of the product by the U.S. Department of Agriculture or an endorsement by the Department over other products not named.

Baggage compartment changes--The shelf and door of the baggage compartment, which are not structural parts of the aircraft, should be removed before installing the dispenser. Fuselage structural modification is avoided by mounting the dispenser so the emission duct protrudes through the baggage door opening. After the dispenser is installed, an aluminum panel is cut to fit around the duct and close the baggage door opening. Sheet metal screws are used to attach the panel to the baggage door frame.

Location of dispenser--The dispenser is mounted on the floor in the baggage compartment so the emission duct is outside the aircraft. Bolts through aluminum angles on the dispenser base are threaded into anchor nuts on the floor to hold the dispenser in place. The top of the hopper is fastened to the baggage door frame for further bracing.

CALIBRATION

Precise calibration of the dispenser before trap dropping operations is necessary to assure accurate trap spacing. If there is wind and the aircraft is flown upwind and downwind, an adjustment must be made in the flying speed of the aircraft or in the conveyor speed to assure that the correct trap drop rate is maintained.

Tables 1-3 were prepared to assist in calibrating the trap dispenser.

Calibration procedures:

(1) After determining the trap spacing and groundspeed to be used, refer to table 1 for the dispersal rates required.

(2) Refer to table 2 to determine the gear combination, motor speed, and voltage that will provide approximately the trap dispersal rates required.

(3) Load the hopper with traps and operate the dispenser while the aircraft is on the ground. Adjust the voltage with the rheostat to produce the exact drop rate.

OPERATION

A special carton was designed to simplify handling the traps, loading them into the aircraft, and filling the hopper. Each carton is open on top and bottom and holds 63 traps. Twine is tied around the carton to hold the traps in the carton. A sill inside and below the upper rim of the dispenser hopper holds the carton in place at the top of the hopper. When the twine is cut, the traps drop into the hopper.

The operator should time the dispersal rate as the first traps are dropped to be certain the calibration is accurate. Slight voltage adjustment can be made to change it. Once the calibration is correct, the trap spacing on the ground will be accurate as long as uniform groundspeed is maintained. When the wind causes a difference in the groundspeed, the pilot should adjust the airspeed to maintain uniform groundspeed or the dispenser operator should vary the speed of the conveyor to maintain a uniform trap spacing. If the pilot maintains a constant airspeed, he should advise the dispenser operator as to his estimated upwind and downwind groundspeeds. The operator can refer to tables 1-3 to determine the necessary adjustments.

Table 1.--Trap dispersal rates at several aircraft groundspeeds for various trap spacings

Trap spacing (feet) 1/	Traps per mile	Traps dropped per minute at actual groundspeeds (m.p.h.) of--				
		110	120	130	140	150
82.5 (1/64)--	64	117.3	128	138.6	149.3	160.0
165.0 (1/32)--	32	58.6	64	69.3	74.6	80.0
330.0 (1/16)--	16	29.3	32	34.6	37.3	40.0
660.0 (1/8)---	8	14.6	16	17.3	18.6	20.0
1,320.0 (1/4)---	4	7.3	8	8.6	9.3	10.0
1,426.6 (1/3)---	3	5.5	6	6.5	7.0	7.5
2,640.0 (1/2)---	2	2.6	4	4.3	4.6	5.0

1/ Numbers in parentheses indicate miles.

Table 2. --Gear combination, motor speed, and voltage for various trap dispersal rates[1/]

Traps dropped per minute	Manufacturer's No.		Motor Speed	Voltage
	Gear A	Gear B		
10----------	Y-64112	Y-6432		
23----------	Y-64144	Y-6456	Low--	6
28----------	Y-64144	Y-6480		
42----------	Y-64192	Y-6432		
93----------	Y-64144	Y-6456	High--	13
120----------	Y-64144	Y-6480		

1/ Rates may differ slightly, as figures are approximate.

Table 3. --Speed-control adjustments and trap dispersal rates for a given gear combination[1/]

Traps dropped per minute at indicated motor speed	Voltage	Traps dropped per minute at indicated motor speed	Voltage
Low:		High:	
9----------	6	20----------	6
12----------	7	24----------	7
15----------	8	26----------	8
18----------	9	30----------	9
20----------	10	32----------	10
23----------	11	36----------	11
26----------	12	41----------	12
28----------	12.7	44----------	12.7

1/ Gear A, 3-inch pitch diameter (mfr. No. Y-64192); gear B, 0.5-inch pitch diameter (mfr. No. Y-6432). Similar tables may be set up for other gear combinations.

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